

DOCUMENT RESUME

ED 479 568

IR 022 174

AUTHOR Kuan, Eric Lim Tze; Weber, Ian
TITLE E-Learning: In Search of a Total Learning Experience (TLE).
PUB DATE 2002-10-00
NOTE 9p.; In: E-Learn 2002 World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education. Proceedings (7th, Montreal, Quebec, Canada, October 15-19, 2002); see IR 022 093.
AVAILABLE FROM Association for the Advancement of Computing in Education (AACE), P.O. Box 3728, Norfolk, VA 23514. Tel: 757-623-7588; e-mail: info@aace.org; Web site: <http://www.aace.org/DL/>.
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE EDRS Price MF01 Plus Postage. PC Not Available from EDRS
DESCRIPTORS *Computer Assisted Instruction; Computer Mediated Communication; *Distance Education; Educational Development; Educational Theories; *Instructional Design; Instructional Development; Learning Strategies; Learning Theories; *Teaching Models; Technology Integration

ABSTRACT

This paper provides a holistic approach to viewing the e-learning phenomenon from a theoretical perspective. It constructs a framework for e-learning development by drawing upon the literature for learning models, knowledge management and utilization of technology for electronic education. In so doing, it conceptualizes the continuous and progressive phases of infrastructure, infostructure and knowledge-structure integration to leverage information and communication technologies (ICTs) more efficiently and effectively for the delivery of a holistic learning experience. By applying this developmental model, the e-learning practitioner possesses an evaluative tool to enable an upward spiral process of continuous feedback and improvements to the e-learning architecture and contribute more strategically to the development of a total learning experience. For the learner, the model generates strategic value from knowledge creating and sharing activities. (Contains 44 references.) (Author)

E-Learning: In Search of a Total Learning Experience (TLE)

PERMISSION TO REPRODUCE AND
DISSEMINATE THIS MATERIAL IN
MICROFORM ONLY HAS BEEN GRANTED BY

G.H. Marks

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)

Eric Lim Tze Kuan
School of Communication and Information
Nanyang Technological University
Singapore
emani@singnet.com.sg

Ian Weber
School of Communication and Information
Nanyang Technological University
Singapore
tigweber@ntu.edu.sg

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

This document has been reproduced as
received from the person or organization
originating it.

Minor changes have been made to
improve reproduction quality.

Points of view or opinions stated in this
document do not necessarily represent
official OEI position or policy.

Abstract: This paper provides a holistic approach to viewing the e-learning phenomenon from a theoretical perspective. It constructs a framework for e-learning development by drawing upon the literature for learning models, knowledge management and utilization of technology for electronic education. In so doing, it conceptualizes the continuous and progressive phases of infrastructure, infostructure and knowledge-structure integration to leverage Information & Communication Technologies (ICTs) more efficiently and effectively for the delivery of a holistic learning experience. By applying this developmental model, the e-learning practitioner possesses an evaluative tool to enable an upward spiral process of continuous feedback and improvements to the e-learning architecture and contribute more strategically to the development of a total learning experience. For the learner, the model generates strategic value from knowledge creating and sharing activities.

Introduction

Decisions to embrace the use of learning technologies for managing and working in the new digital and knowledge economies have fundamentally changed global business and social landscapes. With this increasing emphasis on a knowledge-driven e-based society, learning has been given center stage for its potential in developing the individual through instilling a proactive learning attitude essential for dealing with the dynamism of a complex environment (Sangster, Maclaran and Marshall, 2000). Educators such as Rosenberg (2001) have advocated the merger of Infocomm Technologies (ICT) with educational philosophies to create an integrative virtual learning or "e-learning" environment. Most research in the area of e-learning has focused on the pivotal role of ICT in the process of learning (see Davies, 2000; Lee, 2000; Collis et al., 2000). Others dismissed such emphasis on the technical aspect of e-learning and instead, contended that technology serves merely as a facilitator. Though insightful, these arguments exist on extreme ends of the e-learning continuum and represent a constrained perspective of an otherwise dynamic field. Considering the extensive implications of e-learning on the digital economy, this paper suggests an alternative holistic approach of viewing the e-learning phenomenon, resulting in a framework for e-learning development. The proposed model will draw upon available literature on learning models, knowledge management issues and the utilization of technology for electronic education.

E-learning: Integrating Learning, Knowledge and Information Technology

E-learning is gaining momentum in the managerial and academic arena. Organizations are actively searching for effective e-learning strategies whereas researchers have begun their initial explorations into the definitions and perspectives of the e-learning phenomenon.

28

ED 479 568

IR022174

Distance Education

One prevalent definition of e learning is the use of assisting technologies to create educational opportunities without regards to both time and space (Jarvis, 1993). This emerging model of learning whereby learners can access the educational content "anytime, anywhere" has been commonly coined as "distance education" (Mangan, 2001). Distance education has been well received among business organizations and learning institutions for its flexibility in delivering an equilibrium between the need for knowledge acquisition and the fragmented time schedule of individual learners. For example, studies conducted by Pitcher et al. (2000) have demonstrated that substantial cost savings and efficiency can be obtained from the widespread use of distance learning in higher education.

With the progression in ICT, distance education has manifested into various forms, ranging from virtual classrooms (Hiltz, 1992) to the formal delivering strategy of telelearning (Collis, 1996) and the electronic platforms of cyberschools in the new knowledge society (Jones, 1998). Mangan (2001) has intuitively summarized these developments by classifying distance learning into computer-based training (CBT), videoconferencing and Web-based training (WBT). Others such as Sanderson and Scivier (1998) advocate the alternative use of computer-mediated communication (CMC) as the main component of virtual seminars to imitate conventional forums by simulating a digital collaborative learning environment. However, Veen et al. (1998) questions the effectiveness of such virtual seminars. In response, Tansley and Bryson (2000) championed the need for corresponding infrastructural and social changes in order to ensure the overall success of virtual seminars. Furthermore, Persico and Manca (2000) included customizability as a dimension to be considered in designing CMC systems so as to provide a simple and easy interface that is user-friendly and configurable in accordance to different learning principles.

More recently, the popularity of the Internet has attracted its share of advocates, who are quick to propose the Web as becoming part of the mainstream infrastructure in distance learning (Cole, 1998; Houlder, 1998). Indeed, the Web is hailed as the next revolution in education because of its time and geographical independence; its ease in delivering and updating information; its improved interactivity; its user-centric environment and its capacity to accommodate an almost infinite number of learners (Marchionini and Maurer, 1995; Kapur and Stillman, 1997; Lee et al., 1997; Mudge, 1999). Nevertheless, despite the Internet's ability to transcend time and space, studies by Thomas (2000) have proved that students in practice still prefer to maintain some form of physical contact. Moreover, the Web is often criticized for overloading the user with excessive and irrelevant information (Nielson, 1995). As such, Grabinger and Dunlap (1995) advised that though it is imperative to have the accessibility to the richness and variety of materials available from the Internet, the specific learning goals should not be overlooked.

Though evidence points to distance learning as an efficient technique for offering high quality education for students in any geographical locations (Burke and Gill, 2000), findings by Al-Kodmany et al. (1999) have suggested that technology should supplement traditional teaching methodologies rather than supplant them. Hence, it is necessary to look beyond the technical elements of distance education and examine more closely how such initiatives can be effectively integrated into existing learning philosophies.

Learning Models

The conventional learning model originates as an objectivist model, in which a reality exists and experts instruct individuals of that reality (Belanger and Slyke, 2000). However, the emergence of learner-centric approaches such as constructivism and socio-culturalism has overshadowed conventional ideas and lent weight to the empowerment of individuals to take charge of their own learning environments. Learning theories such as andragogy (Knowles, 1984), minimalism (Carroll, 1990; Van der Meij and Carroll, 1995), experiential learning (Rogers, 1969; Kolb, 1984) and action learning (Revans, 1980) have established strong links between learning and the practicality of doing.

Although these constructs of learning may differ in their perceptions towards the provision of education, they share two common objectives: to emphasize the value of learning by doing and the importance of ensuring an enriching learning experience for the learners. Moreover, as highlighted by Alavi (1994), learning is most effective when it involves the process of problem solving through collaborative brainstorming. With the improved connectivity and increased interactivity of ICT, these commonalities will prove to be pivotal to the delivery of a holistic learning experience for the students.

A comparison between the different learning philosophies is summarized in Table 1 below:

Learning Model	Advocators	Characteristics
Experiential Learning	Rogers, 1969; Kolb, 1984	- Application of knowledge to address the specific needs and requirements of the learner. - Learning is primarily focused on problem solving and the learner is totally involved in and has control over the nature and direction of the learning experience
Andragogy (Adult Learning)	Knowles, 1984	- Learning is facilitated when adults learn experientially in a self motivated, problem solving approach to grasp topics of immediate value.
Minimalism	Carroll, 1990; Van der Meij and Carroll, 1995	- Describes a framework for learning that emphasizes the value of unobtrusive learning content in facilitating self-directed learning activities.
Constructivism	Tobin and Tippins, 1993; Leidner and Jarvenpaa, 1995; Brandt, 1997	- A learning process whereby knowledge is created from using what is known to find sense in experiences. - New information gathered through experiences is integrated with existing mental models to result in expanded, more complex mental models.
Cognitive Information Processing	Bovy, 1981; Leidner and Jarvenpaa, 1995	- A learning model, which proposes learners as having their own individual learning frame of references and only information that has been processed can result in actual learning. - Individuals tend to rely on their prior knowledge obtained from their mental model of the particular domain of expertise to process new information.

Table 1: A Comparison of Learning Models

Apparently, from the table, learning is most efficient when the learning environment is customized to meet the specific needs of individual learners and most effective when learning is facilitated through collaborative problem solving. In other words, learning efficiency is enhanced when learners require the least effort to access the learning facilities such as in the situation where e-learning is accessible "anytime, anywhere" (Rosenberg, 2001), making it convenient for learning to occur within fragmented time schedule and thus conserving substantial time resources. Effectiveness on the other hand, refers to the capacity of learning to generate value for the learners and this can be best addressed when learning is seamlessly integrated into the solution of learner-centric problems such as the case where e-learning can provide for collaborative information and knowledge sharing activities tailored towards topic-specific discussions. Hence, the merger of efficiency and effectiveness in learning completes the universe of an enriching, directional learning experience and embodies the fundamentals of knowledge creation, retention and utilization. It is, therefore, imperative to examine the integration of knowledge management into the learning process and understand how they can complement each other in the provision of an e-learning future.

Knowledge Management (KM)

As pointed out by Nonaka (1991), the management of knowledge plays a pivotal role in the heart of any organization's human resource strategy. Nonaka (1994) devised what he termed as the "Spiral of Knowledge", which explains the creation of knowledge through conversions between tacit and explicit knowledge. Explicit knowledge refers to the visible, expressible form of information that can be transmitted in a formal, systematic manner whereas tacit knowledge is often associated with intangible individual experiences. Nonaka proposes that there are four different modes of knowledge conversion and for each of these modes; Nonaka (1994) attaches a method of knowledge creation. Socialization is the activity that binds individuals from differing backgrounds and experiences to create tacit knowledge because the mere transfer of information would be meaningless without some form of common understanding (Nonaka, 1994). However, this tacit knowledge must be transformed into explicit knowledge through the process of externalization such that the knowledge can be organized in a logical, systematic format, which can be easily conveyed and comprehended to a wider audience. When different bodies of explicit knowledge are combined through the use of social processes, the reconfiguration of existing information through sorting, adding, re-categorizing and re-contextualizing can lead to the creation of new explicit knowledge. Internalization is the last mode of knowledge conversion within the cycle and involves the creation of tacit knowledge from explicit knowledge whenever individuals make use of the shared explicit knowledge as a basis upon which to broaden, extend and reframe their own tacit knowledge base. By injecting ICT into the fundamental knowledge

architecture that supports these knowledge-creating activities, the learning experience can be effectively enhanced and strategized.

The "learning organization", as described by Prokesch (1997), is one such example that has successfully made ICT an integral component of knowledge management activities. In essence, the learning organization is structured to leverage knowledge by replicating it efficiently amongst the individuals with the use of ICT such that each participant is not learning in isolation (i.e. knowledge sharing activities are facilitated through a single information infrastructure). This notion of a learning organization is also shared in the works of LeonardBarton (1992), who further emphasizes the importance of empowering individuals so that they may have the self-confidence, freedom and motivation to continuously solve problems and learn to reinvent in the process. In this way, the level of knowledge can be homogenized throughout the community and, thus, bridging the widening knowledge gap.

Communities of Practice (CoP) is another management strategy that focuses on the effective sharing of knowledge to generate strategic learning value (Wenger and Snyder, 1999). CoP refers to groups of people informally bounded by shared expertise and passion for a joint purpose. A community of practice may not have an explicit agenda and within it, people share their experiences and knowledge in free-flowing, creative ways that foster new approaches to problems. Hence, a familiar, conducive learning environment is fostered within CoP that encourages the creation of new knowledge through collaborate learning and develops the individuals' ability to build and exchange knowledge.

From the previous discussion, e-learning can be perceived to be one of the following:

- *The Integration of Technology into the Process of Learning.* In this case, e-learning is explained as an innovation of technological advancement and dismisses the intangible qualities of the dynamic learning process for greater efficiency in information diffusion capability. Nevertheless, literature from such technical perspectives of viewing e-learning supplies insights that can be adapted to characterize the **technical infrastructure** required for an effective e-learning experience.
- *The Extension of Student-Centric Learning Models onto Virtual Environment.* This practice is simply concerned with the wholesale shoveling of traditional learning models onto new communication mediums and does not consider the possibilities of innovative learning opportunities that are present through the marriage of ICT with conventional educational philosophies. A true learner-centric model does not perform the mundane task of providing stagnant educational material through new communication media. Rather, by having students as the center of attention, e-learning must be able to appreciate individual learning requirements and supply educational content that can best match those needs. In other words, any learning information provided over the underlying infrastructure should be timely, accurate and relevant; the core of a **sound infostructure**.
- *The Management of Knowledge Activities using ICT.* This area of study only focuses on the issues of knowledge creation and sharing but does not provide an explicit link between the knowledge activities and the underlying information structure (infostructure) that is required to support these activities. Given the dynamism of the new economy, the value and lifespan of any form of knowledge is ultimately decided by the characteristics of the information upon which the knowledge is obtained. Moreover, despite the fact that existing knowledge literature is based primarily on organizational studies, it does not imply that these knowledge practices cannot be adopted on an individual learner level. Such organizational knowledge initiatives represent viable options for e-learning to generate strategic value for the individual learner as well. The **knowledge-structure** examines the ways in which knowledge practices can be applied to enhance learning on a larger social scale.

Nonetheless, each of the above perspectives represents just one dimension from which to examine an otherwise multi-faceted discipline and as such e-learning should be considered from a more holistic perspective. The discussion section provides an e-learning model that encompasses the various aspects of ICT, learning models and knowledge management into a singular educational architecture.

Discussion

From the discussions, a holistic view of e-learning would then be the integration of the above three dimensions into a unified strategic educational framework (i.e. e-learning involves the leveraging of ICT to deliver efficient and effective learning to individuals so as to generate strategic value from knowledge creating and sharing activities and in so doing, provide a *Total Learning Experience (TLE)*)

to the learners). Specifically, the e-learning developmental and evaluative framework should comprise three continuous and progressive phases: the *infrastructure*, the *infostructure* and the *knowledge-structure* (see Figure 1).

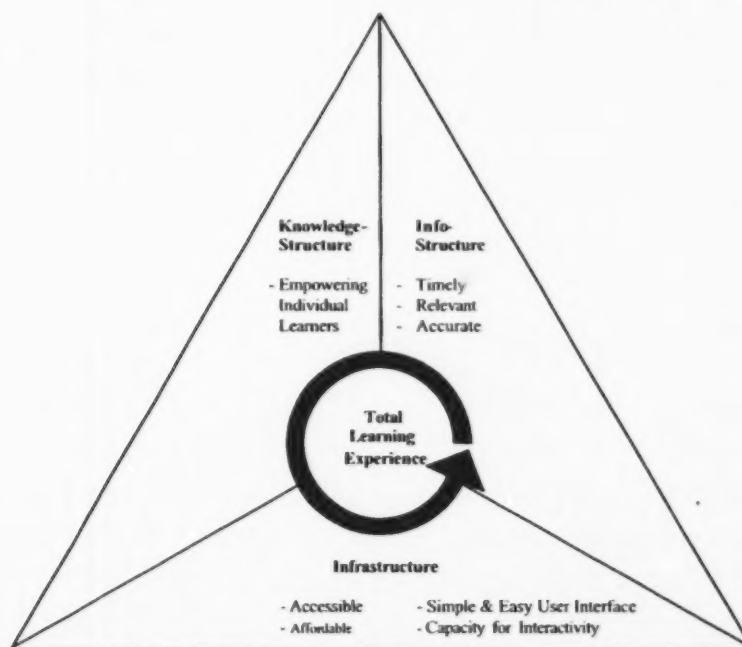


Figure 1: Total Learning Framework

Depicted in the above diagram, Infrastructure refers to the supporting technologies upon which the subsequent info- and knowledge-structures rest. It represents the foundation of e-learning by clearly defining the characteristics of ICT that should be present to facilitate a total learning process:

1. The technology should be accessible to all interested parties. Accessibility in learning is not constrained to pure geographical proximity; it is also the ability to transcend time in the delivery of learning content. As suggested by Rosenberg (2001), the requirements of learners with different time restrictions can be best met if learning can be done "anytime, anywhere". In this respect, the improved connectivity brought about by advancement in ICT acts as a convenient platform for educators to efficiently disseminate their materials to audiences of a greater reach.
2. In addition, the user interface, through which the educational content is being delivered, should be simple to navigate and easy to master. As suggested by the minimalism learning model, navigation is an important factor of effective learning because even if the educational materials are made readily available for the learners, their intended purpose will be defeated if the learners find difficulties in locating them. The degree of complexity in mastering the use of the delivery mechanism is another area of concern. If the technicalities involved in receiving the learning content require a substantial level of technical competence, then potential learners may be deterred.
3. The third characteristic of an effective learning infrastructure is the affordability of the supporting technologies. As evidenced in the study by Carville and Mitchell (2000), technologies such as video conferencing exist as "a relatively inexpensive way of providing remote students with the nearest thing to 'face-to-face' teaching". This observation bears practical implications for e-learning since the value of e-learning is derived primarily from participative learning and as such, it shares similar characteristics with the Internet in the sense that the degree of benefits to be reaped from the learning process is directly proportional to the level of participation. Hence, a cost-effective infrastructure for the learners is an essential

condition for e-learning to maximize its potential in the creation of knowledge by encouraging critical mass participation.

4. Finally, the technical infrastructure for e-learning should possess the capacity for significant interactivity. Interactivity among learners is not a new trend in learning. Since the birth of student-centric education, classroom discussions have already been incorporated as an integral part of the curriculum and in recent years, collaborative brainstorming has become a recognized technique in problem-centric learning (Alavi, 1994). However, interactions of such have long been constrained by the need for physical presence and can only occur on a fixed or limited scale. With the latest changes in ICT, interactivity in e-learning can now take place virtually at almost infinite capacity, which in turn has contributed substantially to expansions in the scope of educational discourses.

Despite an effective infrastructure, a TLE would not have been possible without an equally effective infostructure. Infostructure is the normative structure of information for e-learning that builds on the foundations of infrastructure and acts as the facilitating architecture for the ultimate aim of knowledge creation. In particular, the infostructure defines the characteristics of educational content that will blueprint an efficient and effective learning process:

1. Firstly, the learning content of an effective educational process should always be timely. As illustrated by Rosenberg (2001), speed is the essence of the digital society and time can either be a competitive asset or liability. In other words, the lifespan of information has been substantially shortened with rapid progression in ICT and learning can no longer be a dormant process. In fact, long gone are the days when educational content can remain stagnant for years to come as information is updated constantly. Hence, a crucial component of an effective e-learning framework would be the timeliness of the information being disseminated to the learners.
2. The second aspect of an efficient infostructure would be the relevance of the learning materials. In an age where information is the social currency, learners are often bombarded or even confused by the overwhelming amount of information available from multiple sources. Termed as information overload, this chaotic phenomenon posed a threat to effective education because learners' resources would be wasted in sifting out the required information. It is, therefore, in the basics of e-learning to understand the learners' objectives through interactions and then supply the relevant learning materials that best match their expectations and specific needs. In essence, the relevance of the learning information is associated to the learning model of cognitive information processing (Bovy, 1981; Leidner and Jarvenpaa, 1995) where it is commonly believed that learners possess their own individual perceptions of what constitutes relevant learning information and as such, learning is most effectively managed in e-learning since the same educational content can be effortlessly and inexpensively personalized to suit the needs of individual learners.
3. The third and last characteristic of an e-learning infostructure is the accuracy of the educational content, which must be ensured in the learning process. Similar to the case of relevancy as discussed above, the huge and disorganized flow of information places a question mark on the value of every piece of information and erodes the confidence of e-learners. As such, for e-learning to take off, the accuracy of information contained within the pages of the learning materials should not be compromised. Moreover, constructivism (Tobin and Tippins, 1993; Leidner and Jarvenpaa, 1995; Brandt, 1997) assumes the creation of new knowledge as the integration of new information into existing knowledge base and hence, underlining the dangers of misguided information towards the expansion of an individual learner's knowledge base.

Once the supporting infra- and info-structures are in place, it is now viable to develop the knowledge activities (knowledge - structure) that support the total learning process. As opposed to the previous two phases, the knowledge-structure is not a tangible process with definitive characteristics. Instead, the knowledge architecture emphasizes the cultivation of an inherent knowledge management mentality within each learner so as to actualize the full potential within each individual. This knowledge-structure builds upon the physical learning foundations and considers the mannerism in which such mentality can be realized in the very nature of individual learners. Typically, empowerment of the individual is derived from the cultivation of such thinking to create the self-confidence, freedom and motivation that is necessary to continuously solve problems creatively and to reinvent in the process (Leonard-Barton, 1992). However, empowerment is not attained simply by delivering educational content to the doorsteps of the learner through electronic media; rather, it is the induction

of a proactive approach to the learning process and it can only occur through the realization of an effective infra- and info-structure. Without connectivity to a wider and more diverse group of learners through the use of ICT, the individual would be synonymous to that of an everyday classroom student. It is only with the accessibility of a much greater reach brought about by ICT that individual learners are truly empowered to interact freely with one another. Furthermore, empowerment is not truly complete without the sound and reliable supporting role of the infostructure. The exchange of information during interactions must obey the characteristics of the infostructure presented above in order to solve problems not only creatively, but also timely and accurately.

Summarizing the above discussion, e-learning can be conceived to be an unbiased collaboration of the Infrastructure, Infostructure and Knowledge-structure to deliver a TLE to learners. Each of these phases possesses definitive characteristics that act as the governing boundaries for the development of a TLE and together, these characteristics constitute an evaluative framework for e-learning practitioners. As illustrated in the model, the evaluative analysis is an upward, spiraling process of continuous improvements to the e-learning architecture, which are governed by the dynamics of the three structures so as to realize the full potential of a TLE. Moreover, it should be emphasized at this point that the evaluation of any e-learning development can be performed at any phase of its development, be it the infrastructure, infostructure or knowledge-structure, so long as the characteristics of the overall e-learning architecture are fulfilled.

Conclusion

The total learning framework presented is a preliminary model for the practical development of e-learning. By projecting the framework as a combination of three spiraling structures and defining their essential characteristics, the total learning model serves as guiding principles for practitioners in the development of e-learning modules. However, considering the dynamism of economic and social changes, the model is never intended to be fully comprehensive. Full empirical studies are required to support and expand on this model so as to fine-tune it to make it applicable for the effective management of e-learning initiatives. An important emphasis of this paper is the subtle but crucial message that learning is never meant to be a mono-dimensional and static process. Instead, it must feed on the capabilities of technology and the limitless potential of the mind to develop and expand into a strategic, creative routine of society.

References

- Alavi, M. (1994). Computer-mediated collaborative learning: an empirical evaluation. *MIS Quarterly*, 18, 2, pgs. 159 – 174.
- Al-Kodmany, K., George, R. V., Marks, A., and Skach, J. (1999). A case study of teaching an urban design course on two campuses simultaneously. *ALN Magazine*, 3, 1.
- Belanger, F., and Slyke, C. V. (Spring 2000). End-user learning through application play. *Information Technology, Learning, and Performance Journal*, 18, 1, pgs. 61 – 70.
- Bovy, R. (1981). Successful instructional methods: a cognitive information processing approach. *Educational Computing and Technology Journal*, 29, 4, pgs. 203 – 217.
- Brandt, D. (1997). Constructivism: teaching for understanding of the Internet. *Communications of the ACM*, 40, 10, pgs. 112 – 117.
- Burke, R. H., and Gill, M. (2000). The experience of distance learning at the scarman centre: the realities and the prospects. *Innovations in Education and Training International*, 37, 3, pgs. 286 – 289.
- Carroll, J. (1990) *The Nurnberg funnel*, Cambridge, MA: MIT Press.
- Carville, S., and Mitchell, D. R. (2000). 'It's a bit like star trek': the effectiveness of videoconferencing. *Innovations in Education and Training International*, 37, 1, pgs. 42 – 49.
- Cole, G. (1998). New wave learning. *Times Educational Supplement* 9 January.
- Collis, B. (1996). *Tele-learning in a Digital World: The Future of Distance Learning*. London, UK: International Thompson Computer Press, pgs. 541-588.
- Collis, B., Peters, O., and Pals, N. (2000). Influences on the educational use of the WWW, Email and Videoconferencing. *Innovations in Education and Training International*, 37, 2, pgs. 108 – 119.
- Davies, P. (2000). Computerized peer assessment. *Innovations in Education and Training International*, 37, 4, pgs. 346 – 355.

- Grabinger, R. S., and Dunlap, J. C. (1995). Rich environments for active learning: a definition. *Association of Learning Technology Journal*, 3, 2, pgs. 5 - 9.
- Hiltz, S. R. (1992). Constructing and evaluating a virtual classroom. In Lea, M. (ed.), *Contexts of Computer Mediated Communication*, Harvester Wheatsheaf, London.
- Houlder, V. (1998). Information technology: an appetite for high tech. *Financial Times*, 19 January.
- Jarvis, P. (1993). The education of adults and distance education in late modernity. In Keegan, D. (ed.), *Theoretical Principles of Distance Education*, Routledge, London and New York.
- Jones, R. G. (1998). *Cyberschools*. Jones Digital Century, Incorporated.
- Kapur, S., and Stillman, G. (1997). Teaching and learning using the World Wide Web: a case study. *Innovations in Education and Training International*, 34, 4, pgs. 316 - 322.
- Knowles, M. (1984). *The Adult Learner: A neglected species* (3rd ed.). Houston: Gulf Publishing.
- Kolb, D. A. (1984). *Experiential Learning*. Eaglewood Cliffs, NJ: Prentice Hall.
- Lee, D. (2000). The Effect of Using a Hypermedia Learning Model for a CBI Design Course. *Innovations in Education and Training International*, 37, 2, pgs. 120 - 128.
- Lee, S., Groves, P., and Stephens, C. (1997). Existing tools and projects for online teaching. *JISC Technology Application Programme*.
- Leidner, D. E., and Jarvenpaa, S. L. (1995). The use of information technology to enhance management school education: a theoretical view. *MIS Quarterly*, 19, 3, pgs. 265 - 291.
- Leonard-Barton, D. (Fall 1992). The factory as a learning factory. *Sloan Management Review*, pgs. 23 - 38.
- Mangan, P. (Fall 2001). What is distance learning?. *Management Quarterly*, pgs. 30 - 5.
- Marchionini, and Maurer. (1995). The roles of digital libraries in teaching and learning. *Communications of the ACM*, 38, 4, pgs. 67 - 70.
- Mudge, S. M. (1999). Delivering multimedia teaching modules via the internet. *Innovations in Education and Training International*, 36, 1, pgs. 11 - 16.
- Nicolson, J. (1995). *Multimedia and Hypertext: The Internet and Beyond*. Mountain View.
- Nonaka, I. (1991). The knowledge-creating company. *Harvard Business Review*, pgs. 96 - 104.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organizational Science*, 5, 1, pgs. 14 - 35.
- Persico, D., and Manca, S. (2000). Use of FirstClass as a collaborative learning environment. *Innovations in Education and Training International*, 37, 1, pgs. 34 - 41.
- Pitcher, N., Davidson, K., and Goldfinch, J. (2000). Videoconferencing in higher education. *Innovations in Education and Training International*, 37, 3, pgs. 199 - 209.
- Prokesch, S. E. (1997). Unleashing the power of learning: an interview with British Petroleum's John Browne. *Harvard Business Review*, pgs. 5 - 20.
- Revans, R. (1980). *Action Learning*. London: Blong and Briggs.
- Rogers, C. (1969). *Freedom to Learn*. Columbus, OH: Merrill.
- Rosenberg, M. J. (2001). *E-learning: Strategies for Delivering Knowledge in the Digital Age*. McGraw-Hill.
- Sanderson, P. and Scivier, J. (1998). Virtual seminars: educational benefits and institutional considerations. CTI Conference, York.
- Sangster, A., Maclaran, P., and Marshall, S. (2000). Translating theory into practice: facilitating work-based learning through IT. *Innovations in Education and Training International*, 37, 1, pgs. 50 - 58.
- Tansley, C., and Bryson, C. (2000). Virtual seminars - a variable substitute for traditional approaches?. *Innovations in Education and Training International*, 37, 4, pgs. 335 - 345.
- Thomas, R. (2000). Evaluating the effectiveness of the Internet for the delivery of an MBA programme. *Innovations in Education and Training International*, 37, 2, pgs. 97 - 102.
- Tobin, K., and Tippins, D. (1993). 'Constructivism as a referent for teaching and learning', In Tobin, K. (ed.), *The Practice of Constructivism in Science Education*. Washington, DC: AAAS Press, pgs. 3 - 21.
- Van der Meij, H., and Carroll, J. (1995). Principles and heuristics for designing minimalist instruction. *Technical Communications*, 42, 2, pgs. 243 - 261.
- Veen, W., Lam, I., and Taconis, R. (1998). A virtual workshop as a tool for collaboration: towards a model of telematic learning environments. *Computers and Education*, 30, 1 - 2, pgs. 31 - 39.
- Wenger, E. C., and Synder, W. M. (2000). Communities of practice: the organizational frontier. *Harvard Business Review*, pgs. 139 - 145.



*U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)*



NOTICE

Reproduction Basis

- ☒ This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.
- ☐ This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").